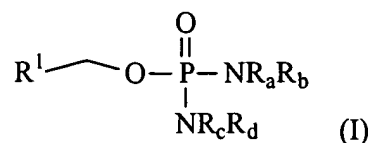


## CLAIMS

What is claimed is:

1. A compound a compound of formula I:



wherein:

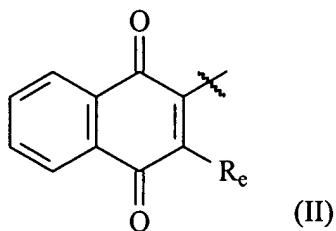
$\text{R}^1$  is an organic releasing group comprising a quinone ring;

$\text{R}_a$ ,  $\text{R}_b$ ,  $\text{R}_c$ , and  $\text{R}_d$  are each independently hydrogen,  $(\text{C}_1\text{-C}_6)\text{alkyl}$ , or  $-\text{CH}_2\text{CH}_2\text{X}$ ; and

each X is independently halo,  $(\text{C}_1\text{-C}_6)\text{alkylsulfonyl}$ , halo $(\text{C}_1\text{-C}_6)\text{alkylsulfonyl}$ , or arylsulfonyl, wherein each aryl is optionally substituted with one or more (e.g. 1, 2, 3, or 4) halo,  $(\text{C}_1\text{-C}_6)\text{alkyl}$ , halo $(\text{C}_1\text{-C}_6)\text{alkyl}$ ,  $(\text{C}_1\text{-C}_6)\text{alkoxy}$ ,  $(\text{C}_1\text{-C}_6)\text{alkanoyl}$ ,  $(\text{C}_1\text{-C}_6)\text{alkanoyloxy}$ ,  $(\text{C}_1\text{-C}_6)\text{alkoxycarbonyl}$ , cyano, nitro, or trifluoromethoxy;

provided at least two of  $\text{R}_a$ ,  $\text{R}_b$ ,  $\text{R}_c$ , and  $\text{R}_d$  are  $-\text{CH}_2\text{CH}_2\text{X}$ ; or a pharmaceutically acceptable salt thereof.

2. The compound of claim 1 wherein  $\text{R}^1$  is a group of formula (II):

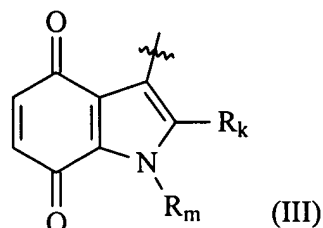


wherein  $\text{R}_e$  is hydrogen, halo,  $(\text{C}_1\text{-C}_6)\text{alkyl}$ , halo $(\text{C}_1\text{-C}_6)\text{alkyl}$ ,  $(\text{C}_1\text{-C}_6)\text{alkoxy}$ ,  $(\text{C}_1\text{-C}_6)\text{alkanoyloxy}$ , cyano, nitro, or  $(\text{C}_1\text{-C}_6)\text{alkylthio}$ ;

and wherein the benz ring is optionally substituted by one or more (e.g. 1, 2, 3, or 4) hydroxy, halo,  $(\text{C}_1\text{-C}_6)\text{alkyl}$ , halo $(\text{C}_1\text{-C}_6)\text{alkyl}$ ,  $(\text{C}_1\text{-C}_6)\text{alkoxy}$ ,  $(\text{C}_1\text{-C}_6)\text{alkylthio}$ ;  $(\text{C}_1\text{-C}_6)\text{alkanoyl}$ ,  $(\text{C}_1\text{-C}_6)\text{alkanoyloxy}$ ,  $(\text{C}_1\text{-C}_6)\text{alkoxycarbonyl}$ , cyano, nitro, mercapto, trifluoromethoxy, or  $\text{NR}_f\text{R}_g$ ; wherein each  $\text{R}_f$  and  $\text{R}_g$  is independently hydrogen,  $(\text{C}_1\text{-C}_6)\text{alkyl}$ ,  $(\text{C}_1\text{-C}_6)\text{alkanoyl}$ , phenyl, benzyl, or

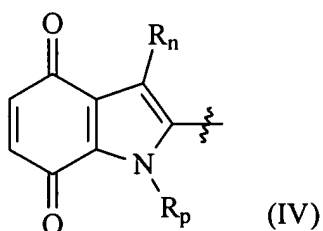
phenethyl; or  $R_f$  and  $R_g$  together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino.

3. The compound of claim 1 wherein  $R^1$  is a group of formula (III):



wherein  $R_k$  is hydrogen or (C<sub>1</sub>-C<sub>6</sub>)alkyl;  $R_m$  is hydrogen or (C<sub>1</sub>-C<sub>6</sub>)alkyl, phenyl, benzyl, or phenethyl; and wherein the benz ring is optionally substituted by one or two hydroxy, halo, (C<sub>1</sub>-C<sub>6</sub>)alkyl, halo(C<sub>1</sub>-C<sub>6</sub>)alkyl, (C<sub>1</sub>-C<sub>6</sub>)alkoxy, (C<sub>1</sub>-C<sub>6</sub>)alkylthio; (C<sub>1</sub>-C<sub>6</sub>)alkanoyl, (C<sub>1</sub>-C<sub>6</sub>)alkanoyloxy, (C<sub>1</sub>-C<sub>6</sub>)alkoxycarbonyl, cyano, nitro, mercapto, trifluoromethoxy, or  $NR_fR_g$ ; wherein each  $R_f$  and  $R_g$  is independently hydrogen, (C<sub>1</sub>-C<sub>6</sub>)alkyl, (C<sub>1</sub>-C<sub>6</sub>)alkanoyl, phenyl, benzyl, or phenethyl; or  $R_f$  and  $R_g$  together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino.

4. The compound of claim 1 wherein  $R^1$  is a group of formula (IV):



wherein  $R_n$  is hydrogen or (C<sub>1</sub>-C<sub>6</sub>)alkyl;  $R_p$  is hydrogen or (C<sub>1</sub>-C<sub>6</sub>)alkyl, phenyl, benzyl, or phenethyl; and wherein the benz ring is optionally substituted by one or two hydroxy, halo, (C<sub>1</sub>-C<sub>6</sub>)alkyl, halo(C<sub>1</sub>-C<sub>6</sub>)alkyl, (C<sub>1</sub>-C<sub>6</sub>)alkoxy, (C<sub>1</sub>-C<sub>6</sub>)alkylthio; (C<sub>1</sub>-C<sub>6</sub>)alkanoyl, (C<sub>1</sub>-C<sub>6</sub>)alkanoyloxy, (C<sub>1</sub>-C<sub>6</sub>)alkoxycarbonyl, cyano, nitro, mercapto, trifluoromethoxy, or  $NR_fR_g$ ; wherein each  $R_f$  and  $R_g$  is independently hydrogen, (C<sub>1</sub>-C<sub>6</sub>)alkyl, (C<sub>1</sub>-C<sub>6</sub>)alkanoyl, phenyl, benzyl, or

phenethyl; or R<sub>f</sub> and R<sub>g</sub> together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino.

5. The compound of claim 1 wherein X is bromo, chloro, mesyl, trifluoromethylsulfonyl, or tosyl.
6. The compound of claim 1 wherein X is bromo.
7. The compound of claim 2 wherein R<sub>e</sub> is hydrogen, halo, methyl, or methylthio.
8. The compound of claim 3 wherein R<sub>k</sub> is hydrogen or methyl.
9. The compound of claim 3 wherein R<sub>m</sub> is hydrogen or methyl.
10. The compound of claim 4 wherein R<sub>n</sub> is hydrogen or methyl.
11. The compound of claim 4 wherein R<sub>p</sub> is hydrogen or methyl.
12. The compound of claim 1 wherein R<sub>a</sub> is (C<sub>1</sub>-C<sub>6</sub>)alkyl.
13. The compound of claim 1 wherein R<sub>c</sub> is (C<sub>1</sub>-C<sub>6</sub>)alkyl.
14. The compound of claim 1 wherein R<sub>a</sub> and R<sub>b</sub> are each independently -CH<sub>2</sub>CH<sub>2</sub>X.
15. The compound of claim 1 wherein R<sub>c</sub>, and R<sub>d</sub> are each independently -CH<sub>2</sub>CH<sub>2</sub>X.
16. The compound of claim 1 wherein R<sub>b</sub> and R<sub>d</sub> are each independently -CH<sub>2</sub>CH<sub>2</sub>X.

17. The compound of claim 1 wherein  $R_a$  is methyl.
18. The compound of claim 1 wherein  $R_c$  is methyl.
19. The compound of claim 1 wherein  $R_a$  and  $R_b$  are each  $-\text{CH}_2\text{CH}_2\text{Br}$ .
20. The compound of claim 1 wherein  $R_c$ , and  $R_d$  are each  $-\text{CH}_2\text{CH}_2\text{Br}$ .
21. The compound of claim 1 wherein  $R_b$  and  $R_d$  are each  $-\text{CH}_2\text{CH}_2\text{Br}$ .
22. The compound of claim 1 wherein  $R_a$  and  $R_b$  are each independently  $-\text{CH}_2\text{CH}_2\text{Cl}$ .
23. The compound of claim 1 wherein  $R_c$ , and  $R_d$  are each independently  $-\text{CH}_2\text{CH}_2\text{Cl}$ .
24. The compound of claim 1 wherein  $R_b$  and  $R_d$  are each independently  $-\text{CH}_2\text{CH}_2\text{Cl}$ .
25. The compound of claim 1 which is:  
2-(1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl) phosphorodiamidate;  
2-(3-Methyl-1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl)  
phosphorodiamidate;  
2-(3-Thiomethyl-1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl)  
phosphorodiamidate;  
2-(3-Bromo-1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl)  
phosphorodiamidate;  
2-(1,4-Naphthoquinonyl)methyl *N,N*-bis(2-bromoethyl) phosphorodiamidate;  
2-(3-Methyl-1,4-naphthoquinonyl)methyl *N,N*-bis(2-bromoethyl)  
phosphorodiamidate;  
2-(1,4-Naphthoquinonyl)methyl bis[*N*-(2-chloroethyl)]  
phosphorodiamidate;

2-(1,4-Naphthoquinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;  
2-(3-Methyl-1,4-naphthoquinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;  
2-(1,4-Naphthoquinonyl)methyl bis[*N*-methyl-*N*-(2-chloroethyl)]phosphorodiamidate;  
3-(5-Methoxy-1-methyl-4,7-indolequinonyl)-methyl bis[*N*-methyl-*N*-(2-bromoethyl)] phosphorodiamidate;  
3-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;  
2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;  
2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-chloroethyl)-phosphorodiamidate; or  
2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;  
or a pharmaceutically acceptable salt thereof.

26. The compound of claim 1 which is:

3-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;  
2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;  
2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-chloroethyl)-phosphorodiamidate; or  
2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;  
or a pharmaceutically acceptable salt thereof.

27. A pharmaceutical composition comprising a compound of claim 1, in combination with a pharmaceutically acceptable diluent or carrier.

28. A therapeutic method for preventing or treating cancer comprising administering to a mammal in need of such therapy, an effective amount of a compound of claim 1.
29. The method of claim 28 wherein the cancer is a solid tumor.
30. The method of claim 28 wherein the cancer is a solid tumor.
31. A method for preparing a compound of formula I as described in claim I, wherein R<sup>1</sup> is a group of formula II, III, or IV, comprising oxidizing a corresponding compound of formula I wherein R<sup>1</sup> is a group of formula VI, VII, or VIII.